The devoicing of fricatives in a reading task

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1. Introduction

One of the main pronunciation differences between the varieties of standard Dutch as spoken in the Netherlands and Flanders, is to be found in the voice characteristics of /ɣ/, /v/ and /z/ (Van de Velde, Gerritsen and Van Hout 1996). They showed that in the Netherlands /ɣ/, /v/ and /z/ are affected by a strong devoicing process. In most cases, /ɣ/ is realized as a voiceless fricative (Van den Broecke and Van Heuven 1979; Slis and Van Heugten 1989). Somewhat surprisingly, in Flanders slight devoicing of /v/ and /z/ was observed in the 1990's. Flemish /ɣ/ is often devoiced, which is confirmed by phonetic experiments by Debrock (1977:76). This study of fricative devoicing is part of a large scale study on the pronunciation of standard Dutch (Van Hout et al. 1999), of which the subjects are presented in Section 2. The study focuses on the analysis of the external factors community, region, age and sex and on the relationship between the three fricatives. The stimuli of the reading experiment and the methods of data collection and transcription are described in Section 3. The research questions are sketched in Section 4, the results are presented in Section 5. The conclusions are summarized in Section 6.

2. Subjects

The subjects are 160 Dutch language teachers, stratified for community (2), region (4), sex (2) and age (2), as can be seen in Table 1. The subjects were selected from schools in middle-sized cities. All subjects participated in a Flemish-Dutch research project on the pronunciation of standard Dutch (Van Hout et al. 1999). We opted for Dutch language teachers. They are professional language users speaking standard Dutch on a daily basis. Second, as instructors of the standard language they play an important normative role. Van de Velde and Houtermans (1999)

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showed that they are accepted as a normative authority, second to broadcasters. Compared to broadcasters, Dutch language teachers will probably show more pronunciation variation.

Table 1. The corpus of Dutch language teachers, stratified for community, region, sex and age (N = 160)

		Core	**Intermediate**	**Peripheral 1 →**	**Peripheral 2**
The Netherlands		Randstad	Middle	North	South
Young	Male	5	5	5	5
	Female	5	5	5	5
Middle	Male	5	5	5	5
	Female	5	5	5	5
Flanders		Brabant	East-Flanders	West-Flanders	Limburg
Young	Male	5	5	5	5
	Female	5	5	5	5
Middle	Male	5	5	5	5
	Female	5	5	5	5

Subjects were selected in four regions in both the Netherlands and Flanders. In the Netherlands these regions are: 1. the Randstad, i.e. the economic and cultural centre of the Netherlands, which also appears to be the core area for ongoing changes in the standard language (cities: Alphen aan den Rijn, Gouda); 2. Middle, i.e. an intermediate zone in the South of the province of Gelderland, along the borders of the Great Rivers (Culemborg, Ede, Elst, Tiel, Veenendaal); 3. North, a peripheral area in Groningen and the North of Drenthe (Assen, Veendam, Winschoten); 4. South, a second peripheral area, i.e. Limburg (Geleen, Roermond, Sittard). In Flanders we were able to cover the four dialect regions: 1. Brabant, i.e. the economic and cultural centre of Flanders, which also appears to be the core area for ongoing changes in the standard language (Heist-op-den Berg, Lier); 2. East-Flanders, an intermediate zone (Oudenaarde, Zottegem); 3. West-Flanders, a peripheral zone in the west (Ieper and Poperinge); 4. Limburg, a second peripheral area in the east (Bilzen, Tongeren).

At the time of data collection, subjects were living in the region, had lived there before their 8th birthday, and had been living there for at least eight years before their 18th birthday. Two age groups were distinguished: young (between 22 and 40) and middle (between 45 and 60). As for sex, a biological distinction between male and female was made.

3. Method

The subjects were clearly instructed about the aim of the research project: a study of standard Dutch pronunciation in the Netherlands and Flanders. Part of the questionnaire aims at eliciting the best articulated realization of all phonemes of Dutch in a linguistic context which is the same for all vowels and consonants respectively. Therefore, the phonemes are put in a carrier sentence. For consonants in word initial position, a schwa-like environment is the most neutral context. The schwa is the most central vowel and is unrounded. However, it cannot occur in a stressed position. Therefore, the word initial consonant is preceded by a word ending in schwa (i.e. *de*) and followed by /œy/. For our variables (g), (v) and (z) the carrier sentences are:

In de guize horen we g	(in the 'guize' we hear 'g')
In de vuize horen we v	(in the 'vuize' we hear 'v')
In de zuize horen we z	(in the 'zuize' we hear 'z')

The subjects were instructed to pronounce the single consonant as a combination of the consonant with schwa. However, this realization is not transcribed. 17 sentences covering the Dutch consonants in word initial position were presented with intervals of three seconds on the screen of a powerbook by means of a PowerPoint presentation. The subjects had to do the reading task twice, with an interval of about 20 minutes. Five random orders were used, each order occurring once in every cell. For the second task the items were presented in reverse order. The total number of tokens in this study is 960: 160 speakers x 3 variables x 2 realizations per variable.

The speech of the subjects was recorded on digital audiotape with a portable TASCAM DA-P1 recorder and an AKG C420 headset microphone. The recordings were digitalized on computer and down-sampled to 16 kHz (16 bits). For the auditory analysis each sentence was saved as a separate sound file. Two trained transcribers, one being a Flemish native speaker of Dutch, the other a native speaker of French with a limited knowledge of Dutch, made separate transcriptions of the voice characteristics of the variables on the basis of an auditory analysis and a visual analysis of the spectrum. Afterwards, if the transcriptions did not agree the two transcribers made a consensus transcription. In cases of doubt a third trained transcriber (a native speaker of Dutch from the Netherlands) was consulted.

4. Research questions

The formal style of reading aloud a series of specific phonemes in carrier sentences results in a restricted stylistic range of speech. The aim of the task was to elicit the

target standard realization of each subject. The fact that speakers had to perform the task twice has two possible effects: 1. a stable choice indicating that the speaker has a clear norm; 2. variability (i.e. having two different realizations) indicating that the speaker does not have a clear norm. The specificity of this reading task and the results of previous studies of the devoicing of fricatives in Dutch lead to the expectations given in Table 2.

Table 2. Overview of expected effects for (g), (v) and (z)

	(g)	**(v)**	**(z)**
Community	+	+	+
Region the Netherlands	+	+	+
Region Flanders	−	−	−
Age	−	±	±
Sex	−	−	−
Variability the Netherlands	−	±	+
Variability Flanders	−	−	−
Order	1	2	3

It is expected that only the strongest factors will show significant effects. Labov (1972: 239, 242) showed that in formal speech, social differentiation is smaller than in less formal speech styles. Especially in reading tasks all social categories tend to use the most standard variants. First, an effect of community is expected: (g), (v) and (z) will be more devoiced in the Netherlands than in Flanders. Second, regional effects in the Netherlands are expected: the Randstad will be the most devoiced area, Limburg will have the most voiced realizations for all variables. In Flanders, regional effects are not expected. Third, we do not expect an age effect for (g), as it is commonly realized as voiceless. As devoicing of /v/ and /z/ are changes in progress in northern standard Dutch, we expect that in the Netherlands the young age group will devoice (v) and (z) more than the middle age group. In southern standard Dutch, such differences are not expected, although Van de Velde et al. (1996) found weak devoicing of (v) and (z) in the speech of Flemish broadcasters from the 1990's. Fourth, an effect of the factor sex is not expected. Slis (1985) found that women devoice slightly more than men. For this difference a physiological explanation is given: women have shorter vocal cords than men, and it is more difficult to make shorter vocal cords vibrate (Van Heuven and Rietveld 1997: 323). We expect that this small effect will not show up in this formal reading experiment, in which speakers heavily monitor their articulation. Fifth, there are different expectations concerning variability in the Netherlands and Flanders. In Flanders, speakers have a clear norm: voiced realizations of (v) and (z); (g) can be devoiced,

but it is a phenomenon below the level of consciousness. Consequently, speakers will have stable pronunciation patterns. In the Netherlands we expect stability for (g): except for Limburg (it is popular belief that (g) is voiced in Limburg, but Goeman (1993) showed that it is often voiceless), the norm is a voiceless pronunciation. For (z) variation is expected. The change from [z] to [s] is noticed by the members of the language community, and a lot of them still consider the voiceless pronunciation of /z/ as non-standard. Also a lot of hypercorrections, /s/ realized as [z], are observed. This linguistic insecurity may result in variability for (z). The shift from [v] to [f] is less observed, and a voiceless pronunciation of /v/ as [f] is less stigmatized. If variability occurs, it is expected to show up in the areas showing most devoicing of /v/. At last, we expect that the order of devoicing, systematically observed in real time, will be reflected in this study of contemporary speech: (g) is more devoiced than (v), (v) shows more devoicing than (z) (cf. Gussenhoven 1981; Voortman 1994).

5. Results

In this contribution we focus on the voice dimension in the pronunciation of the fricatives. Place is a primary characteristic for (g) as well, but in this paper the results are restricted to voice. The reading task was performed twice by every subject, resulting in two realizations of each of the three fricatives (g), (v) and (z). The combination of auditory judgments and visual inspection produced three variants, first of all the fully voiced (+voice) and the fully voiceless variants (−voice). The remaining variant is partially voiced (±voice). Table 3 gives an overview of the distribution of the three variants per fricative.

Table 3. Absolute and relative frequencies of variants of (g), (v) and (z) (k = 320 per variable)

	(g)	**%**	**(v)**	**%**	**(z)**	**%**
+voice	27	8.4	138	43.1	154	48.1
±voice	146	45.7	95	29.7	78	24.4
−voice	147	45.9	87	27.2	88	27.5

Table 3 shows a fairly similar distribution pattern of the variants of (v) and (z). They share the same variants and their quantitative distribution is comparable too, the voiced variant being the most frequent one, implying that most speakers still consider voiced realizations of /v/ and /z/ as the norm. (g) clearly got much more voiceless realizations and got at the same time an equally frequent intermediate variant.

Table 4. Distribution of variants of (g), (v) and (z) in %, split up by community and region (k = 320 per phonological variable)

		The Netherlands				Flanders			
		Rand	Middle	North	South	Limb	W-Fl	E-Fl	Brab
(g)	+	0.0	15.0	5.0	12.5	12.5	2.5	17.5	2.5
	±	50.0	25.0	27.5	47.5	72.5	27.5	57.5	57.5
	−	50.0	60.0	67.5	40.0	15.0	70.0	25.0	40.0
(v)	+	17.5	45.0	7.5	50.0	52.5	80.0	40.0	52.5
	±	47.5	15.0	2.5	30.0	37.5	20.0	60.0	25.0
	−	35.0	40.0	90.0	20.0	10.0	0.0	0.0	22.5
(z)	+	52.5	35.0	57.5	35.0	52.5	52.5	55.0	45.0
	±	12.5	27.5	12.5	12.5	30.0	25.0	40.0	35.0
	−	35.0	37.5	30.0	52.5	17.5	22.5	5.0	20.0

The distribution pattern of the three remaining variants for the eight regions in the two communities can be found in Table 4. The patterns of the three phonological variables are given in percentages.

As expected, Table 4 shows that there are more voiceless realizations in the Netherlands than in Flanders. However, voiceless and semi-voiced realizations of (v) and (z) are much more common than expected in Flanders, and large differences between the regions show up. In the Netherlands too, the results do not meet all our expectations. South is the most voiced region for (g) and (v), but contrary to all expectations it turns out to be the region having most voiceless realizations of (z). North shows very strong devoicing of (v). In both the Netherlands and Flanders (v) and (z) do not follow the same patterns.

Of every speaker two occurrences of (g), (v) and (z) were transcribed. In Table 5 the absolute and relative frequency of speakers showing no, small and large variation are given. No variation implies that the subject realized two times the same variant; small variation is a combination of a voiceless or voiced with an intermediate variant; large variation is a combination of the voiced and the voiceless variant. Table 5 shows that variation is smallest for (g) and largest for (z).

In Table 6 the number of speakers showing large variation (44 out of 160) are split up by community and region.

Speakers combining a voiced and a voiceless realization can be considered linguistically insecure, doubting about the standard. In Flanders this type of speaker is rare, except for (z) in the Limburg area. In the Randstad the so-called insecure speakers are rare in comparison with the rest of the Netherlands, which might be a proof of its status as normative region. Speakers from other regions might be in the

Table 5. Variation within speakers. Absolute and relative frequency of speakers showing no, small and large variation for (g), (v) and (z) (N = 160)

	(g)	%	(v)	%	(z)	%
no	114	71.2	114	71.2	89	56.6
small	40	25.0	35	21.9	44	27.5
large	6	3.8	11	6.9	27	16.9

Table 6. Number of speakers showing large variation for (g), (v) and (z), split up by community and region (N = 160)

	The Netherlands				Flanders			
	Rand	Middle	North	South	Limb	W-Fl	E-Fl	Brab
(g)	0	1	2	2	0	1	0	0
(v)	1	5	3	2	0	0	0	0
(z)	3	4	7	6	5	1	0	1

process of adopting this norm. Alternatively, these results might be seen in the light of the view put forward by Van Reenen and Wattel (1992), who claim that the opposition between /z/ and /s/ is not disappearing — as would be the case if /z/ is involved in a process of devoicing, as seems to be the case in standard Dutch (Van de Velde et al. 1996) — but that there is a pattern of rather stable variation, at least in the Dutch dialects. But, why would speakers show variability by producing voiceless realizations in an area where no process of devoicing fricatives seems to be part of neither the contemporary dialects (Weijnen 1991: 240, Van Reenen 1992), nor the standard language (Voortman 1994: 95) spoken there? It cannot be a coincidence that speakers in Dutch Limburg (South) do the same as the speakers in Belgian Limburg for the fricative (z). Perhaps the explanation should be based on processes of strengthening, which is triggered by the reading task asking for a strong pronunciation. Strengthening a voiced fricative along the sonority scale implies devoicing. For the Limburg speakers pronouncing the (z) as clear as possible triggers devoicing. Van Loey (1959: 57) points out that in the history of Dutch 'psychological intensity' is the cause of fricatives remaining voiceless in a series of cases. In our view, this must have been the same kind of strengthening as we observed in Limburg.

Finally, an analysis of the voice pattern for the four external variables (community, region, age and sex) is presented. Indices were computed on the basis of three values: 1 = voiced realization, 2 = intermediate realization, 3 = voiceless realization. The mean scores for (g), (v) and (z) split up by region are presented in Figure 1. The devoicing order found in previous studies is not completely confirmed. (g) is

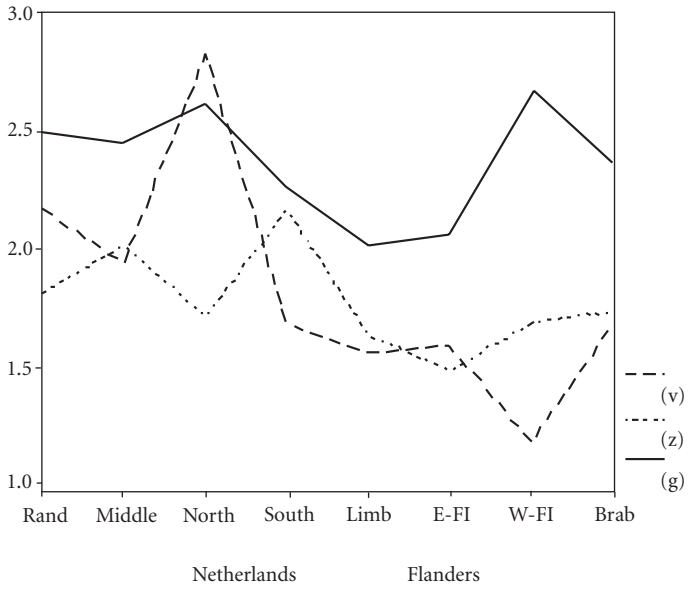

Figure 1. Index scores (1 = completely voiced; 3 = completely voiceless) for (g), (z) and (z) split up by region

devoiced most, but there is no difference between (v) and (z). Remark the region North, where (v) is extremely devoiced (even more than (g)).

The analysis of variance applied is a repeated measures analysis (two realizations of the same fricative) with four between-subject factors (community, region nested under community, age, sex), all between-subjects factors being fixed. This design has a series of 12 within-subjects effects, which all relate to an order effect in the two realizations. Preferably, these effects are not significant, and, if significant, rather small. Two out of the 36 possible effects (three phonological variables by 12 effects) turned out to be significant, which is about the number of effects to be significant on chance level (.05); moreover, the two effects were small. We may skip them here and direct our analysis to the 11 between-subjects effects (the number of effects is limited to 11 per variable as a result of the nesting of the region factor under the community factor). Table 7 contains an overview of those factors which are significant for one of the three variables.

Table 7 shows only seven significant effects, when we do not take into account the more specific region effects of the Netherlands and Flanders. Three significant effects are related to the main factor of community, and two to the main factor of region. The sex effect shows up once (for (g)) and there is one interaction effect of region and age for (z). The three main effects for community are illustrated by

Table 7. Results of the analyses of variance, repeated measures for the two measurements of each fricative, region nested under community; only the significant between-subjects factors are listed, none within-subjects

Factor	(g)	(v)	(z)
Community	*	***	**
Region	***	***	
The Netherlands		***	
Flanders	***	*	
Sex	*		
Region x Age			*

Figure 1. Both the (v) and (z) are more voiceless in the Netherlands; (v), Netherlands = 2.16, Flanders = 1.52; (z), Netherlands = 1.94, Flanders = 1.65. The difference in (g) is less outspoken, but still significant; (g), Netherlands = 2.46, Flanders = 2.29.

Region does not yield a significant effect for (z), which means that within the two communities no differences in the average realization of this fricative exist. The (g) has a significant region effect. Separate analyses of this effect for community show that this effect has to be ascribed to differences in Flanders (see Table 7, the region effects for the Netherlands and Flanders). The deviant region evidently is West-Flanders: (g) West-Flanders = 2.68; Brabant = 2.38; East-Flanders = 2.08; Limburg = 2.03. The significant region effect of (v) returns in both communities, as can be seen in Table 7. The largest differences show up in the Netherlands, primarily by the outspoken position of North: (v) North = 2.83; Randstad = 2.18; Middle = 1.95; South = 1.70. The figures for Flanders, where again West-Flanders has an extreme position, are: (v) West-Flanders = 1.20; Brabant = 1.70; East Flanders = 1.60; Limburg = 1.58. The position of West-Flanders (the most voiced region) is opposite to its position for the (g) (the most voiceless region). It points out that the fricative (g) has a special status in the standard language as spoken in West-Flanders, which is probably linked to its realization in the West-Flemish dialects.

On average the differences for age are not significant. The changes in real time found by Van de Velde et al. (1996) do not return in apparent time. The interaction effect of age by region for (z) is brought about by the opposite outcomes for the Middle and North region in the Netherlands. The differences found for these two regions, which are at the same time the largest age differences for the eight regions, are: middle region, young = 2.35, old = 1.70; north region, young = 1.25, old = 2.20. In the Middle region the younger generation seems to promote the voiceless pronunciation (taking over the Randstad norm), whereas the younger generation in the North seems to turn to the voiced pronunciation. The latter can be seen as a reaction against the local, voiceless pronunciation (see the high amount of de-

voicing for — unstigmatized — (v) by both age groups and Van Reenen and Wattel (1992) for dialect data). The strengths of these effects need further investigation, for instance by using data from other speech styles from our database.

The sex effect for (g) involves a slightly more voiceless pronunciation overall for women in general (women = 2.46, men = 2.29). This small effect can be explained by physiological factors (Slis 1985; see Section 4).

6. Conclusions

In Table 8 the observed effects for (g), (v) and (z) are compared with the expected ones as given in Table 2. Partly, the results of this very formal reading task are in line with those from other studies on very different speech data, e.g. devoicing is much stronger in the Netherlands than in Flanders, variability seems to show up as expected for (g), (v) and (z) in the Netherlands, and fully voiced realizations of (g) are rare all over the Dutch language area. Partly, the results do not always meet our expectations. On the one hand, for some factors, such as region and age in the Netherlands, variation is smaller than expected. In this formal reading task we only found a significant effect for the region factor for (v), and the changes found in real time were not reflected in this apparent time study. On the other hand, differences show up where they were not expected. In Flanders partially voiced and voiceless realizations of (v) and (z) occur much more than expected. Most variation showed up for (z). The high amount of voiceless realizations in the Belgian and Dutch provinces of Limburg (the regions Limburg and South) distorted the picture from previous studies. Consequently, the established order of devoicing ((g) > (v) > (z)) is only partly confirmed: there is no difference between (v) and (z). The small sex effect for (g) is caused by physiological differences between the male and female vocal tract.

Table 8. Overview of expected and observed effects for (g), (v) and (z)

	expected			**observed**		
	(g)	(v)	(z)	(g)	(v)	(z)
Community	+	+	+	+	+	+
Region the Netherlands	+	+	+	−	+	−
Region Flanders	−	−	−	+	+	−
Age	−	±	±	−	−	−
Sex	−	−	−	+	−	−
Variability the Netherlands	−	±	+	−	±	+
Variability Flanders	−	−	−	−	−	±
Order	1	2	3	1	2	2

This study revealed some fascinating results. The very formal reading task we used for data collection confirms existing views on and adds new insights to the study of the devoicing of fricatives. However, the strengths of the effects need further investigation, for instance by using data from other speech styles in our study, other databases or more experimental techniques.

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